RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS

Meeting #5

Spurious Emission Limits

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(Reference Action Item 4-10)

Summary

At the April meeting of RTCA Special Committee 186 Working Group 5, a question was raised regarding requirements on spurious emissions for Universal Access Transceiver (UAT) equipment. The purpose of this paper is to review available material, and propose limits for inclusion in the UAT Minimum Operational Performance Standards (MOPS).

1.0 Background

At the April meeting of RTCA Special Committee 186 Working Group 5, a question was raised regarding requirements on spurious emissions for Universal Access Transceiver (UAT) equipment. The purpose of this paper is to review available material, and propose limits for inclusion in the UAT Minimum Operational Performance Standards (MOPS).

2.0 Reference Material

2.1 Review of Distance Measuring Equipment (DME) standards: RTCA DO-189 MOPS and EUROCAE ED-54 MOPR.

DO-189: "The equipment shall comply with the applicable rules of the Federal Communications Commission."

ED-54: "The equipment shall comply with the applicable International Telecommunications Union Regulations."

2.2 Review of Federal Communications Commission (FCC) Code of Federal Regulations, Title 47, Part 87:

§87.139 (a) Except for ELTs and when using single sideband (R3E, H3E, J3E), or frequency modulation (F9) or digital modulation (F9Y) for telemetry or telecommand in the frequency bands 1435-1535 MHz and 2310-2390 MHz, the mean power of any emissions must be attenuated below the mean power of the transmitters (pY) as follows:

(1) When the frequency is removed from the assigned frequency by more than 50 percent up to an including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB;
(2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB;
(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB; and the attenuation for aeronautical station transmitters must be at least 43+10 log(pY) dB.
…

(d) Except for telemetry in the 1435-1535 MHz band, when the frequency is removed from the assigned frequency bandwidth by more than 250 percent of the authorized bandwidth for aircraft stations above 30 MHz and all ground stations the attenuation must be at least 43+10log(pY) dB.

> §87.135 (a) Occupied bandwidth is the width of a frequency band such that below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 percent of the total mean power of a given emission.
>
> (b) The authorized bandwidth is the maximum occupied bandwidth authorized to be used by a station.

250 percent of occupied bandwidth point is pretty standard as the definition for the start of the "spurious emission" region. If we assume, for example, that the UAT occupied bandwidth is 1 MHz, the spurious emission region starts at +/- 2.5 MHz from the specified center frequency.

2.3 International Telecommunications Union Recommendation ITU-R SM.329-7 (including proposed revisions) is similar (i.e., 43+10log(P)), with one important distinction. In that recommendation, spurious emissions in the band 30 MHz to 1 GHz are always measured with a reference bandwidth of 100 kHz. That value is then compared to the emitted power in the "necessary bandwidth", and the attenuation calculated. In our case, if we assume necessary bandwidth = occupied bandwidth = 1 MHz, and that the spurious emissions are relatively "flat" in the frequency domain, this results in a 10 dB "relaxation" in requirements.

3.0 Conclusion

The Working Group is invited to compare published limits to the draft UAT transmitter mask. Quick review indicates that there may be discrepancies, at least when viewed versus FCC requirements.

4.0 Recommendation

For simplicity, the MOPS text should probably follow the model of previous RTCA and EUROCAE documents, i.e., the standard "will meet necessary FCC/ITU requirements". Care must be taken however to ensure that the proposed equipment does meet those limits.